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TITLE: Method and device for
extracting principal image
subjects

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Detailed Description Text - DETX (31):

The skin color/circular shape extracting section 78 performs skin color and circular shape extractions to extract the face region as the principal part of an image. Stated more specifically, the skin color/circular shape extracting

section 78 detects the hues and saturations of individual pixels from the prescanned data (the data may optionally be thinned out) and extracts a region of pixels (a skin color region) that are estimated to represent a skin color corresponding to the human skin. Human faces are generally elliptical so the skin color/circular shape extracting section 78 then bases on the extracted skin color region to extract an elliptical or circular shape that is estimated to represent the human face and designates it as a candidate face region.

Detailed Description Text - DETX (36):

The synthesis/result evaluating section 82 synthesizes the candidate face regions extracted with the skin color/circular shape extracting section 78 and the face contour/circular shape extracting section 80 and checks from the composite (candidate) face region to see if the result of face extractions is appropriate or not.

Detailed Description Text - DETX (38):

One method of evaluation to be performed by the synthesis/result evaluating section 82 is shown in FIG. 5. The area of region C which is an overlap between the region A extracted by the skin color/circular shape extracting section 78 and the region B extracted by the face contour/circular shape extracting section 80 is determined; if both area ratios C/A and C/B exceed a specified threshold (Th), the result of face

extractions is found to be appropriate; otherwise, the result is found not appropriate.

Detailed Description Text - DETX (39):

Another method of evaluation to be performed with the synthesis/result evaluating section 82 is by weighting the **extracted regions by reliability depending upon the method of extraction** or the like and evaluating the total weighted scores. Referring again to FIG. 5, each of the pixels in the **region A extracted with the skin color**/circular shape extracting section 78 is weighted by a score of one, each of the pixels in the **region B extracted** with the face contour/circular shape extracting section 80 is weighted by a score of two, and each of the pixels in the region C which is an overlap between the two regions is weighted by a score of three and the total weighted scores are calculated for the three regions A, B and C; if they exceed a certain threshold, the result of face extractions is found to be appropriate; otherwise, the result is found not appropriate.

Detailed Description Text - DETX (41):

The criteria (thresholds in the case described above) for evaluating the result of face extractions in the synthesis/result evaluating section 82 may be changed depending on the need. Consider, for example, a close-up of the human face and other images that are believed to be occupied by an extensive area of

a principal part (which may be evaluated by the aforementioned area of skin color) or a scene shot with an electronic flash; in order to reproduce high-quality images, face extraction is preferably performed with high precision and, hence, more strict criteria for evaluation may be adopted. Alternatively, criteria for evaluation may be varied stepwise depending on the area of skin color and the like. Conversely, in the case of ordinary portraits and the like, the face region to be extracted may drop if too strict criteria are adopted; to avoid this problem, less strict criteria may be adopted.

Detailed Description Text - DETX (43):

If the result of extraction is found to be appropriate in the synthesis/result evaluating section 82, the composite face region (or the information about it) is sent to the principal part identifying section 88 so that the principal part of the image is identified.

The method of identifying the principal image part (the principal image subject) in the principal part identifying section 88 is not limited in any particular way. In one exemplary method, all regions extracted in the skin color/circular shape extracting section 78 and the face contour/circular shape extracting section 80 may be identified as the principal part. Alternatively, an overlap between the results of extraction in the two sections may be identified as the principal part.

Detailed Description Text - DETX (80):

In the extracting site 72A shown in FIG. 4, the condition evaluating section can be exemplified by the synthesis/result evaluating section 82 which synthesizes candidate subjects having different characteristics as extracted in the skin color/circular shape extracting section 78 and the face contour/circular shape extracting section 80 served as a plurality of extracting subunits processed in parallel, and which judges whether the results of the subject extraction are appropriate or not on the basis of the extracting regions of the synthesized candidate subjects, and the principal part identifying section 88 for finally identifying the principal part of the image or the principal image subjects. The principal part identifying section 88 can be an example of the condition evaluating section in the last extracting unit 92 which has no extracting subunits.

Detailed Description Text - DETX (84):

The setting site 72B of the setup subsection 72 reads the prescanned data from the prescan memory 52, and on the basis of the acquired prescanned data, constructs density histograms and calculates image characteristic quantities such as average density, highlights (minimum density) and shadows (maximum density) to determine the reading conditions for fine scan; in addition to the density histograms and the image characteristic

quantities, the setting site 72B is based on the principal part of the image extracted by the extracting site 72A and responds to an optionally entered operator command or the like, thereby constructing LUTs for performing gray balance adjustment, tonal correction and density adjustment, constructing MTX operational formulae for performing saturation correction, calculating coefficients for sharpness correction and the otherwise setting conditions for the various image processing schemes and steps to be implemented in the prescanned image processing section 56 and the fine scanned image processing section 58.

Detailed Description Text - DETX (94):

In the extracting site 72A, the method for extracting principal image subjects according to the first aspect of the invention is performed in the manner already described above. Stated more specifically, a face candidate **region is extracted in each of the skin color/circular shape extracting section 78 and the face contour/circular shape extracting section 80; the candidate face regions extracted** in the two sections are assembled in the synthesis/result evaluating section 82 and the result of extractions is evaluated; if the result is appropriate, the switching section 84 connects to the principal part identifying section 88, where the principal part is identified and the information on the identified principal part is sent to the

setting site 72B. If, on the other hand, the result of extractions is found not appropriate in the synthesis/result evaluating section 82, the switching section 84 connects to the body/eye extracting section 86, which is supplied with the result of synthesis and relevant image data to perform an additional face extraction using body and eye extractions; the result of extraction is sent to the principal part identifying section 88, where the principal part is identified and the information on the identified principal part is sent to the setting site 72B.

Detailed Description Text - DETX (110):

While the methods of extracting principal image subjects to be executed in the invention are not limited in any particular way, the following six extractions may be performed in the illustrated extracting site 72A: face extraction by skin color/circular shape extraction; face extraction by face contour/circular shape extraction; face extraction by body/circular shape extraction; face extraction by eye (face's interior structure)/circular shape extraction; face extraction by hairs on head/circular shape extraction; and background extraction. For details of these methods of extracting image subjects, reference may be had to the patents already listed above. To summarize: i) skin color/circular shape extraction involves skin color and circular shape extractions to extract the face region; ii) face

contour/circular shape extraction involves both extracting the face contour by edge extraction and extracting a circular shape to extract the face region;

iii) body/circular shape extraction involves both extracting the body contour by edge extraction and extracting a circular shape to extract the face region;

iv) eye/circular shape extraction involves both extracting human eyes and a circular shape to extract the face region; v) hairs on head/circular shape extraction involves both extracting the hairs on the head by edge extraction and extracting a circular shape to extract the face region; and vi) background extraction uses contour extraction to extract the background behind human individuals, thereby acquiring auxiliary information such as for face extraction.

Detailed Description Text - DETX (123):

The similarity between two images may be evaluated in terms of at least one image characteristic quantity selected from among the average density by region of about six divisions of the image, the shape of a density histogram (as exemplified by the peak position), density distribution, highlight (minimal density), shadow (maximal density), average density and so forth.